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August 5, 2015

Lee Hunt
518 Old Santa Fe Trail, #501
Santa Fe, NM 87505

Re: Gonzales v. Santa Fe County

Dear Mr. Hunt,

Thank you for sending documents in this case and asking for my opinions. I have reviewed the following documents.

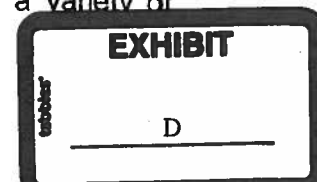
1. *Complaint for Wrongful Death.*
2. *Police Report.*
3. *Santa Fe Fire Department Report.*
4. *St. Vincent Emergency Department First Visit (Visit #1).*
5. *Santa Fe County Youth Development Center.*
6. *St. Vincent Emergency Department Second Visit, Part 1 (Visit #2-A).*
7. *St. Vincent Emergency Department Second Visit, Part 2 (Visit #2-B).*
8. *Death Certificate.*
9. *OMI Autopsy Report.*
10. *Transcript - Medical Review Panel Hearing.*

QUALIFICATIONS

I have reviewed these records as an expert in medical toxicology. I have residency training in Toxicology as well as a post-graduate Master's Degree in Toxicology. I am Board Certified by the American Board of Toxicology. I have been practicing medical, occupational, environmental, and forensic toxicology since 1984. I have been licensed in the State of New Mexico since 1987. In addition, I have residency training and Board Certification in Family Practice and also Occupational and Environmental Medicine.

My testimony has been accepted in a variety of venues. I have been accepted as an expert witness in Metro, State, and Federal Courts in New Mexico; Federal Court in Arizona; and in State Courts in Arizona, Washington, and Oklahoma.

My current medical practice combines patient care and medical consulting. I am the Global Medical Director for Health and Well-being at Intel Corporation. I have an office-based medical practice where I see patients that have been exposed to a variety of



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morphine 880 ng/ml and free 6-monacetylmorphine 130 ng/ml. As determined by the OMI, cause of death was toxic effects of heroin and manner of death was accident.¹⁹

TOXICOLOGY DISCUSSION

The records indicate that Ms. Gonzales's initial clinical findings by emergency responders were consistent with heroin overdose. She was found unconscious and not breathing with a slow heart rate and hypoxia. Naloxone (Narcan) was administered via intranasal and intravenous routes at a combined dose of 1.6 mg. The doses of naloxone served to temporarily block the effects of heroin and rapidly reversed the signs of overdose. During the period of unconsciousness she was unable to protect her airway and may have aspirated some stomach contents into her lungs.

By the time she reached the Emergency Department at St. Vincent Hospital she was awake and alert. During the course of her treatment she exhibited signs of opioid withdrawal consistent with the expected effects of naloxone. These signs included tachycardia, anxiety, agitation and vomiting. Within one hour of receiving the last dose of naloxone she exhibited hypoxia, and low blood pressure necessitating supplemental oxygen. She was given lorazepam intravenously 7 minutes after she was first evaluated by medical personnel at St. Vincent Hospital. She was discharged into police custody with her vital signs just within normal ranges when she was released.

There are 3 drugs involved in this case, each of which must be considered along with their interactions. Heroin is an opioid which is rapidly metabolized in the body to morphine. At lower doses opioids are potent analgesics. At higher doses they can depress the central nervous system (CNS) which can also depress respirations. As in this case, heroin use is associated with respiratory depression and death, even when low "therapeutic" blood levels are found at autopsy, due to continued metabolism following initial unconsciousness and respiratory compromise.²⁰

Lorazepam is also a CNS depressant used for sedation, anxiety and seizures. Any drug that depresses the CNS has additive effects to other CNS depressants. Naloxone is a short acting antagonist of the effects of heroin and many other opioids but has no effect on the action of lorazepam. The administration of benzodiazepines is known to inhibit heroin (morphine) metabolism though clinical relevance is unknown.²¹

The half-life (time it takes for half the blood, serum or plasma concentration to decrease by 50%) and effective duration (duration of pharmacological action) of heroin (morphine) and lorazepam are longer than naloxone. The half-life of morphine is 1.3 to

19 OMI Autopsy Report.

20 Naso-Kaspar CK, et al. 'Lingering' opiate deaths? Concentration of opiates in medulla and femoral blood. *J Anal Toxicol.* 2013;37:507-511.

21 Rook EJ, et al. Pharmacokinetics and pharmacokinetic variability of heroin and its metabolites: Review of the literature. *Current Clinical Pharmacology.* 2006;1(1):109-118.

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6.7 hours, lorazepam 9 to 16 hours, and naloxone 0.5 to 1.5 hours.²² The effective duration of these drugs approximates their respective half-lives.^{23,24}

In this case the combinations of the three drugs is at issue. The first consideration is the combined effect of heroin and naloxone. Because of its short half-life the naloxone found in Ms. Gonzales antemortem blood samples reflects the dose given at the second EMS contact rather than the first. The actual duration of effectiveness of the first dose is not known.

Although there are clinical recommendations for early discharge of heroin overdose patients receiving out-of-hospital naloxone²⁵ there are clearly exceptions. Approximately 20% of naloxone-reversed heroin overdoses demonstrated toxicity recurrence because the effect of naloxone "wears off" before effective dose of heroin does.²⁶ Furthermore, the half-life of naloxone does not predict the true clinical effectiveness in all cases. Naloxone doses similar to that given to Ms. Gonzales has been shown to antagonize the respiratory depressant effect of heroin for over 5 hours.²⁷ In a cohort study, 25% of cases receiving pre-hospital naloxone required naloxone re-administration in the emergency department more than 3 hours after the pre-hospital dose.²⁸ If Ms. Gonzales had a longer than average half-life for either naloxone or heroin the effects of her heroin overdose would be manifest later than 2 hours after the initial naloxone dose and she would have been discharged before the effects of heroin "wore off". The second drug interaction to consider is that between heroin and lorazepam. Ms. Gonzales free morphine level about 4 hours after she was found "out of it" at the correctional facility was 12 ng/ml. Free morphine is approximately 50 to 75% of total morphine²⁹ and her actual total blood level at this time was closer to 15 to

22 Baselt RC. Disposition of Toxic Drugs and Chemicals in Man, 9th Ed. 2011. Biomedical Publications, Seal Beach.

23 Berkowitz BA. The relationship of pharmacokinetics to pharmacologic activity: morphine, methadone and naloxone. *Clin Pharmacokinet*. 1976;1:219-230.

24 Evans JM, Hogg MJ, Lunn JN, Rosen M. Degree and duration of reversal by naloxone of effects of morphine in conscious subjects. *Br Med J*. 1974;2:589-591.

25 Christenson J, et al. Early discharge of patients with presumed opioid overdose: Development of a clinical prediction rule. *Academic Emergency Medicine*. 2000;7:1110-1118.

26 Watson WA, Steele MT, Muelleman RL, Rush MD. Opioid toxicity recurrence after an initial response to naloxone. *Clinical Toxicology*. 1998;36(1&2):11-17.

27 Konieczko KM, et al. Antagonism of morphine-induced respiratory depression with nalmefene. *Br J Anaesth*. 1988;61:318-323.

28 Boyd JJ, et al. Recurrent opioid toxicity after pre-hospital care of presumed heroin overdose patient. *Acta Anaesthesiol Scand* 2006;50:1266-1270.

29 Avilla J, Katz M, Lehrer M. Assessing free and total morphine following heroin overdose when complicated by the presence of